

POWERED BY **Dialog****Dialog eLink:** [Order File History](#)**Thermoelectric semiconductor material - comprises sintered powder of thermoelectric material having rhombohedral or hexagonal structure****Patent Assignee:** KOMATSU ELECTRONICS CO LTD; KOMATSU ELECTRONICS INC; KOMATSU KK; KOMATSU SEISAKUSHO KK**Inventors:** FUKUDA K; KAJIHARA T; KAJIWARA T; SATO Y**Patent Family (11 patents, 22 countries)**

Patent Number	Kind	Date	Application Number	Kind	Date	Update	Type
WO 1998011612	A1	19980319	WO 1997JP3263	A	19970916	199818	B
JP 10178218	A	19980630	JP 1997250624	A	19970916	199836	E
JP 10178219	A	19980630	JP 1997269389	A	19970916	199836	E
EP 959507	A1	19991124	EP 1997940393	A	19970916	199954	E
			WO 1997JP3263	A	19970916		
CN 1233347	A	19991027	CN 1997198779	A	19970916	200010	E
KR 2000036119	A	20000626	WO 1997JP3263	A	19970916	200111	E
			KR 1999702147	A	19990313		
US 6274802	B1	20010814	WO 1997JP3263	A	19970916	200148	E
			US 1999254657	A	19990315		
JP 3219244	B2	20011015	JP 1997269389	A	19970916	200164	E
JP 2002111086	A	20020412	JP 1997250624	A	19970916	200241	E
			JP 2001190514	A	19970916		
JP 3305991	B2	20020724	JP 1997250624	A	19970916	200255	E
CN 1184701	C	20050112	CN 1997198779	A	19970916	200620	E

Priority Application Number (Number Kind Date): JP 1996243811 A 19960913**Patent Details**

Patent Number	Kind	Language	Pages	Drawings	Filing Notes
WO 1998011612	A1	JA	94	36	
National Designated States, Original	CN KR US				
Regional Designated States, Original	AT BE CH DE DK ES FI FR GB GR IE IT LU MC NL PT SE				

JP 10178218	A	JA	31	
JP 10178219	A	JA	20	
EP 959507	A1	EN		PCT Application WO 1997JP3263
				Based on OPI patent WO 1998011612
Regional Designated States,Original	CH DE FR GB IT LI NL SE			
KR 2000036119	A	KO		PCT Application WO 1997JP3263
				Based on OPI patent WO 1998011612
US 6274802	B1	EN		PCT Application WO 1997JP3263
				Based on OPI patent WO 1998011612
JP 3219244	B2	JA	20	Previously issued patent JP 10178219
JP 2002111086	A	JA	29	Division of application JP 1997250624
JP 3305991	B2	JA	30	Previously issued patent JP 10178218

Alerting Abstract: WO A1

A thermoelectric semiconductor material has sufficient strength and performance and high production yield. The thermoelectric semiconductor material is characterised in that a sintered powder material of a thermoelectric semiconductor having a rhombohedral structure (or hexagonal structure) is hot-forged and plastically deformed to direct either the crystals of the sintered powder structure or the quasi-crystals constructing the crystals in a crystal orientation having an excellent performance index.

International Patent Classification

IPC	Level	Value	Position	Status	Version
B22F-0001/00	A	I	L	R	20060101
B22F-0003/17	A	I	L	R	20060101
B22F-0003/24	A	I	F	R	20060101
C01B-0019/04	A	I	F	R	20060101
C22C-0001/04	A	I	F	R	20060101
C22C-0001/04	A	I	L	R	20060101
C22C-0012/00	A	I	L	R	20060101
C22F-0001/00	A	I	L	R	20060101
H01L-0035/16	A	I	L	R	20060101
H01L-0035/16	A	I		R	20060101
H01L-0035/18	A	I	L	R	20060101
H01L-0035/32	A	I	L	R	20060101
H01L-0035/34	A	I	L	R	20060101
H01L-0035/34	A	I		R	20060101
B22F-0001/00	C	I	L	R	20060101
B22F-0003/00	C	I	L	R	20060101
B22F-0003/24	C	I	F	R	20060101
C01B-0019/00	C	I	F	R	20060101
C22C-0001/04	C	I	F	R	20060101
C22C-0001/04	C	I	L	R	20060101
C22C-0012/00	C	I	L	R	20060101
C22F-0001/00	C	I	L	R	20060101
H01L-0035/00	C	I	L	R	20060101
H01L-0035/00	C	I		R	20060101
H01L-0035/12	C	I	L	R	20060101
H01L-0035/12	C	I		R	20060101
H01L-0035/32	C	I	L	R	20060101

US Classification, Issued: 136201, 136205, 136238, 136240

Original Publication Data by Authority

China

Publication Number: CN 1184701 C (Update 200620 E)

Publication Date: 20050112

Assignee: KOMATSU SEISAKUSHO KK; JP (KOMS)

Inventor: FUKUDA K SATO Y KAJIHARA T

Language: ZH

Application: CN 1997198779 A 19970916 (Local application)
 Priority: JP 1996243811 A 19960913
 Original IPC: H01L-35/34(A) H01L-35/16(B)
 Current IPC: H01L-35/00(R,I,M,EP,20060101,20051008,C) H01L-35/12
 (R,I,M,EP,20060101,20051008,C) H01L-35/16(R,I,M,EP,20060101,20051008,A) H01L-35/34
 (R,I,M,EP,20060101,20051008,A)
 Current ECLA class: H01L-35/16 H01L-35/34|CN 1233347 A (Update 200010 E)
 Publication Date: 19991027
 Assignee: KOMATSU KK; JP (KOMS)
 Language: ZH
 Application: CN 1997198779 A 19970916 (Local application)
 Priority: JP 1996243811 A 19960913
 Original IPC: H01L-35/34(A) H01L-35/16(B)
 Current IPC: H01L-35/00(R,A,I,M,EP,20060101,20051008,C) H01L-35/12
 (R,I,M,EP,20061008,20051008,C) H01L-35/16(R,I,M,EP,20060101,20051008,A) H01L-35/34
 (R,I,M,EP,20060101,20051008,A)
 Current ECLA class: H01L-35/16 H01L-35/34

European Patent Office

Publication Number: EP 959507 A1 (Update 199954 E)
 Publication Date: 19991124
****THERMOELEKTRISCHES HALBLEITERMATERIAL, HERSTELLUNGSVERFAHREN DAFUR, UND VERFAHREN ZUM HEISSSCHMIEDEN EINES THERMOELEKTRISCHEN MODULS DER DIESES MATERIAL VERWENDET THERMOELECTRIC SEMICONDUCTOR MATERIAL, MANUFACTURE PROCESS THEREFOR, AND METHOD OF HOT FORGING THERMOELECTRIC MODULE USING THE SAME MATERIAU SEMI-CONDUCTEUR THERMOELECTRIQUE, PROCEDE DE FABRICATION CORRESPONDANT ET PROCEDE DE FORGEAGE A CHAUD D'UN MODULE A BASE DE CE MATERIAU****
 Assignee: KOMATSU LTD., 3-6 Akasaka 2-chome, Minato-ku Tokyo 107, JP (KOMS) KOMATSU ELECTRONICS INC., 2597, Shinomiya, Hiratsuka-shi, Kanagawa 254, JP (KOMA-N)
 Inventor: FUKUDA, Katsushi, Kenkyusho of Komatsu Ltd. 1200, Manda, Hiratsuka-shi Kanagawa 254, JP SATO, Yasunori, Kenkyusho of Komatsu Ltd. 1200, Manda, Hiratsuka-shi Kanagawa 254, JP KAJIHARA, Takeshi, Kenkyusho of Komatsu Ltd. 1200, Manda, Hiratsuka-shi Kanagawa 254, JP
 Agent: Fiener, Josef, Postfach 12 49, 87712 Mindelheim, DE
 Language: EN
 Application: EP 1997940393 A 19970916 (Local application) WO 1997JP3263 A 19970916 (PCT Application)
 Priority: JP 1996243811 A 19960913
 Related Publication: WO 1998011612 A (Based on OPI patent)
 Designated States: (Regional Original) CH DE FR GB IT LI NL SE
 Original IPC: H01L-35/34(A) H01L-35/16(B)
 Current IPC: H01L-35/00(R,A,I,M,EP,20060101,20051008,C) H01L-35/12
 (R,I,M,EP,20060101,20051008,C) H01L-35/16(R,I,M,EP,20060101,20051008,A) H01L-35/34
 (R,I,M,EP,20060101,20051008,A)
 Current ECLA class: H01L-35/16 H01L-35/34
 Original Abstract: A thermoelectric semiconductor material having sufficient strength and performance and high production yield. The thermoelectric semiconductor material is characterized in that a sintered powder material of a thermoelectric semiconductor having a rhombohedral structure (or hexagonal structure) is hot-forged and plastically deformed to direct either the crystals of the sintered powder structure or the subcrystals constructing the crystals in a crystal orientation having an excellent figure of merit.

Claim: 1. A method of manufacturing a thermoelectric semiconductor material comprising: * a heating step in which material powder is mixed so as to have a desired composition, and melted by heating; a solidification step in which a solid solution ingot of thermoelectric semiconductor material having a rhombohedral structure (hexagonal crystal structure) is formed; a crushing step in which the solid solution ingot is crushed to form a solid solution powder, a screening step in which the grain size of the solid solution powder is made uniform; a sintering step in which the solid solution powder whose grain size has been made uniform is subjected to pressing and sintering; and a hot upset forging step in which the powder sintered body is subjected to plastic deformation while hot, and extended, thereby aligning the crystal grains or subcrystal grains constituting the crystal grains of the powder sintered structure in a crystal orientation of excellent figure of merit.

Japan

Publication Number: JP 10178218 A (Update 199836 E)

Publication Date: 19980630

****THERMOELECTRIC SEMICONDUCTOR MATERIAL, ITS MANUFACTURE, THERMOELECTRIC MODULE USING THE SAME AND HOT FORGING METHOD****

Assignee: KOMATSU ELECTRON, KK (KOMS) KOMATSU LTD (KOMS)

Inventor: FUKUDA KATSUSHI SATO YASUTOKU KAJIWARA TAKESHI

Language: JA (31 pages)

Application: JP 1997250624 A 19970916 (Local application)

Priority: JP 1996243811 A 19960913

Original IPC: H01L-35/34(A) B22F-3/24(B) C22C-1/04(B) H01L-35/16(B) H01L-35/32(B)

Current IPC: B22F-3/24(R,A,I,M,JP,20060101,20051220,A,F) B22F-3/24

(R,I,M,JP,20060101,20051220,C,F) C22C-1/04(R,I,M,JP,20060101,20051220,A,L) C22C-1/04

(R,I,M,JP,20060101,20051220,C,L) H01L-35/00(R,I,M,JP,20060101,20051220,C,L) H01L-35/12

(R,I,M,JP,20060101,20051220,C,L) H01L-35/16(R,I,M,JP,20060101,20051220,A,L) H01L-35/32

(R,I,M,JP,20060101,20051220,A,L) H01L-35/32(R,I,M,JP,20060101,20051220,C,L) H01L-35/34

(R,I,M,JP,20060101,20051220,A,L)|JP 10178219 A (Update 199836 E)

Publication Date: 19980630

****THERMOELECTRIC SEMICONDUCTOR MATERIAL AND THERMOELECTRIC MODULE USING THE SAME****

Assignee: KOMATSU ELECTRON, KK (KOMS) KOMATSU LTD (KOMS)

Inventor: FUKUDA KATSUSHI SATO YASUTOKU KAJIWARA TAKESHI

Language: JA (20 pages)

Application: JP 1997269389 A 19970916 (Local application)

Priority: JP 1996243811 A 19960913

Original IPC: H01L-35/34(A) C22C-1/04(-) H01L-35/16(B) H01L-35/32(B)

Current IPC: C22C-1/04(R,A,I,M,JP,20060101,20051220,A,F) C22C-1/04

(R,I,M,JP,20060101,20051220,C,F) H01L-35/00(R,I,M,JP,20060101,20051220,C,L) H01L-35/12

(R,I,M,JP,20060101,20051008,C) H01L-35/16(R,I,M,JP,20060101,20051008,A) H01L-35/32

(R,I,M,JP,20060101,20051220,A,L) H01L-35/32(R,I,M,JP,20060101,20051220,C,L) H01L-35/34

(R,I,M,JP,20060101,20051220,A,L)

Current ECLA class: H01L-35/16|JP 2002111086 A (Update 200241 E)

Publication Date: 20020412

****THERMOELECTRIC SEMICONDUCTOR MATERIAL, ITS PRODUCING METHOD AND THERMOELECTRIC MODULE AND HOT FORGING METHOD EMPLOYING IT****

Assignee: KOMATSU SEISAKUSHO KK (KOMS) KOMATSU LTD (KOMS)

Inventor: FUKUDA KATSUSHI SATO YASUTOKU KAJIWARA TAKESHI

Language: JA (29 pages)

Application: JP 1997250624 A 19970916 (Division of application) JP 2001190514 A 19970916 (Local application)

Priority: JP 1996243811 A 19960913

Original IPC: H01L-35/34(A) B22F-1/00(B) B22F-3/17(B) C01B-19/04(B) C22C-12/00(B) C22F-1/00(B) H01L-35/16(B) H01L-35/18(B)

Current IPC: B22F-1/00(R,I,M,JP,20060101,20051220,A,L) B22F-1/00(R,I,M,JP,20060101,20051220,C,L) B22F-3/00(R,I,M,JP,20060101,20051220,C,L) B22F-3/17(R,I,M,JP,20060101,20051220,A,L) C01B-19/00(R,I,M,JP,20060101,20051220,C,F) C01B-19/04(R,I,M,JP,20060101,20051220,A,F) C22C-12/00(R,I,M,JP,20060101,20051220,A,L) C22C-12/00(R,I,M,JP,20060101,20051220,C,L) C22F-1/00(R,I,M,JP,20060101,20051220,A,L) C22F-1/00(R,I,M,JP,20060101,20051220,C,L) H01L-35/00(R,I,M,JP,20060101,20051220,C,L) H01L-35/12(R,I,M,JP,20060101,20051220,C,L) H01L-35/16(R,I,M,JP,20060101,20051220,A,L) H01L-35/18(R,I,M,JP,20060101,20051220,A,L) H01L-35/34(R,I,M,JP,20060101,20051220,A,L)|JP 3219244 B2 (Update 200164 E)

Publication Date: 20011015

Language: JA (20 pages)

Application: JP 1997269389 A 19970916 (Local application)

Priority: JP 1996243811 A 19960913

Related Publication: JP 10178219 A (Previously issued patent)

Original IPC: H01L-35/34(A) C22C-1/04(-) H01L-35/16(B) H01L-35/32(B)

Current IPC: C22C-1/04(R,A,I,M,JP,20060101,20051220,A,F) C22C-1/04(R,I,M,JP,20060101,20051220,C,F) H01L-35/00(R,I,M,JP,20060101,20051220,C,L) H01L-35/12(R,I,M,EP,20060101,20051008,C) H01L-35/16(R,I,M,EP,20060101,20051008,A) H01L-35/32(R,I,M,JP,20060101,20051220,A,L) H01L-35/32(R,I,M,JP,20060101,20051220,C,L) H01L-35/34(R,I,M,JP,20060101,20051220,A,L)

Current ECLA class: H01L-35/16|JP 3305991 B2 (Update 200255 E)

Publication Date: 20020724

Language: JA (30 pages)

Application: JP 1997250624 A 19970916 (Local application)

Priority: JP 1996243811 A 19960913

Related Publication: JP 10178218 A (Previously issued patent)

Original IPC: H01L-35/34(A) B22F-3/24(B) C22C-1/04(B) H01L-35/16(B) H01L-35/32(B)

Current IPC: B22F-3/24(R,A,I,M,JP,20060101,20051220,A,F) B22F-3/24(R,I,M,JP,20060101,20051220,C,F) C22C-1/04(R,I,M,JP,20060101,20051220,A,L) C22C-1/04(R,I,M,JP,20060101,20051220,C,L) H01L-35/00(R,I,M,JP,20060101,20051220,C,L) H01L-35/12(R,I,M,JP,20060101,20051220,C,L) H01L-35/16(R,I,M,JP,20060101,20051220,A,L) H01L-35/32(R,I,M,JP,20060101,20051220,A,L) H01L-35/32(R,I,M,JP,20060101,20051220,C,L) H01L-35/34(R,I,M,JP,20060101,20051220,A,L)

Republic of Korea

Publication Number: KR 2000036119 A (Update 200111 E)

Publication Date: 20000626

Assignee: KOMATSU KK (KOMS) KOMATSU ELECTRONICS INC (KOMA-N)

Language: KO

Application: WO 1997JP3263 A 19970916 (PCT Application) KR 1999702147 A 19990313 (Local application)

Priority: JP 1996243811 A 19960913

Related Publication: WO 1998011612 A (Based on OPI patent)

Original IPC: H01L-35/34(A)

Current IPC: H01L-35/00(R,A,I,M,EP,20060101,20051008,C) H01L-35/12(R,I,M,EP,20060101,20051008,C) H01L-35/16(R,I,M,EP,20060101,20051008,A) H01L-35/34(R,I,M,EP,20060101,20051008,A)

Current ECLA class: H01L-35/16 H01L-35/34

United States

Publication Number: US 6274802 B1 (Update 200148 E)

Publication Date: 20010814

****Thermoelectric semiconductor material, manufacture process therefor, and method of hot forging thermoelectric module using the same.****

Assignee: Komatsu Ltd., Tokyo, JP (KOMS)

Inventor: Fukuda, Katsushi, Hiratsuka, JP Sato, Yasunori, Hiratsuka, JP Kajihara, Takeshi, Hiratsuka, JP

Agent: Varndell Varndell, PLLC

Language: EN

Application: WO 1997JP3263 A 19970916 (PCT Application) US 1999254657 A 19990315 (Local application)

Priority: JP 1996243811 A 19960913

Related Publication: WO 1998011612 A (Based on OPI patent)

Original IPC: H01L-35/34(A)

Current IPC: H01L-35/00(R,A,I,M,EP,20060101,20051008,C) H01L-35/12

(R,I,M,EP,20060101,20051008,C) H01L-35/16(R,I,M,EP,20060101,20051008,A) H01L-35/34

(R,I,M,EP,20060101,20051008,A)

Current ECLA class: H01L-35/16 H01L-35/34

Original US Class (main): 136201

Original US Class (secondary): 136205 136238 136240

Original Abstract: A thermoelectric semiconductor material having sufficient strength and performance and high production yield. The thermoelectric semiconductor material is characterized in that a sintered powder material of a thermoelectric semiconductor having a rhombohedral structure (or hexagonal structure) is hot-forged and plastically deformed to direct either the crystals of the sintered powder structure or the subcrystals constructing the crystals in a crystal orientation having an excellent figure of merit.

Claim: 1.A method of manufacturing a thermoelectric semiconductor material comprising: * a heating step in which material powder is mixed so as to have a desired composition, and melted by heating; * a solidification step, in which a solid solution ingot of thermoelectric semiconductor material having a rhombohedral structure is formed; * a crushing step in which the solid solution ingot is crushed to form a solid solution powder; * a screening step in which the grain size of the solid solution powder is made uniform; * a sintering step in which the solid solution powder whose grain size has been made uniform is subjected to pressing and sintering; and * a hot upset forging step in which the powder sintered body is subjected to plastic deformation while hot, and extended, so that crystal grains or subcrystal grains constituting the crystal grains of the powder sintered structure are aligned in a crystal orientation of excellent figure of merit for providing a thermoelectric material of satisfactory strength and performance; and * a further heat treatment step in which heat treatment is performed after the hot upset forging step.

WIPO

Publication Number: WO 1998011612 A1 (Update 199818 B)

Publication Date: 19980319

****THERMOELECTRIC SEMICONDUCTOR MATERIAL, MANUFACTURE PROCESS THEREFOR, AND METHOD OF HOT FORGING THERMOELECTRIC MODULE USING THE SAME****

Assignee: KOMATSU LTD., 3-6, AKASAKA 2-CHOME, MINATO-KU, TOKYO 107, JP (KOMS)
KOMATSU ELECTRONICS INC., 2597, SHINOMIYA, HIRATSUKA-SHI, KANAGAWA 254, JP (KOMS)

Inventor: FUKUDA, KATSUSHI, KENKYUSHO OF KOMATSU LTD., 1200, MANDA, HIRATSUKA-SHI KANAGAWA 254, JP SATO, YASUNORI, KENKYUSHO OF KOMATSU LTD., 1200, MANDA, HIRATSUKA-SHI KANAGAWA 254, JP KAJIHARA, TAKESHI, KENKYUSHO

OF KOMATSU LTD., 1200, MANDA, HIRATSUKA-SHI KANAGAWA 254, JP

Language: JA (94 pages, 36 drawings)

Application: WO 1997JP3263 A 19970916 (Local application)

Priority: JP 1996243811 A 19960913

Designated States: (National Original) CN KR US (Regional Original) AT BE CH DE DK ES FI FR GB GR IE IT LU MC NL PT SE

Original IPC: H01L-35/34(A) H01L-35/16(B)

Current IPC: H01L-35/00(R,A,I,M,EP,20060101,20051008,C) H01L-35/12

(R,I,M,EP,20060101,20051008,C) H01L-35/16(R,I,M,EP,20060101,20051008,A) H01L-35/34

(R,I,M,EP,20060101,20051008,A)

Current ECLA class: H01L-35/16 H01L-35/34

Original Abstract: A thermoelectric semiconductor material having sufficient strength and performance and high production yield. The thermoelectric semiconductor material is characterized in that a sintered powder material of a thermoelectric semiconductor having a rhombohedral structure (or hexagonal structure) is hot-forged and plastically deformed to direct either the crystals of the sintered powder structure or the quasi-crystals constructing the crystals in a crystal orientation having an excellent performance index.

Derwent World Patents Index

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